25th Congress, 2d Session. [Rep. No. 463.] Ho. of Reps.

SHIP CANAL AROUND THE FALLS OF NIAGARA.

[To accompany bill H. R. No. 466.]

January 25, 1838.

Mr. Grant, from the Committee on Roads and Canals, made the following

REPORT:

The Committee on Roads and Canals, to which was referred the report of the Secretary of War, of the result of the survey of the several routes of a ship canal around the Falls of Niagara, to connect the navigable waters of the Lakes Erie and Ontario, together with the several memorials on the same subject, have had the same under consideration, and beg leave to report:

That at the 2d session of the 24th Congress the same committee had the subject under their consideration, and a report was submitted to the House by the Honorable Gideon Hard, one of its members, exhibiting both the great utility and feasibility of this important national work. To this able report the committee invite the attention of the House, and acknowledge themselves indebted for many of the facts and arguments herein imbodied.

It appears the attention of Congress was first called to notice this important project in the year 1808, in pursuance of a resolution of the other branch of the Legislature, calling upon the Secretary of the Treasury to report a scheme of internal improvements, embracing such objects only as were deemed within the legitimate powers of Congress, and were worthy of its action. In that report was included the work now under consideration. One object of your committee, in referring to that report, is to show that this is no new project; but one which, at a very early day, before the commerce on the northern lakes was known or even fully anticipated; before the tide of emigration had set to the West, when western New York was in its infancy, and the now populous western States scarcely known, except as one vast forest, was considered national, and as worthy of the efficient aid of the National Government. Since that period two other surveys have been made; one in 1826, prosecuted under the auspices of an association of private individuals; the other in 1835, under direction of Captain W. G. Williams, United States topographical engineer, pursuant to an order of the late Executive. These several surveys put the entire feasibility of this work beyond the reach of controversy. The report and survey of Captain Williams exhibits the great skill of that faithful officer, and bears the strongest impress of scientific examination, and correctness of detailed estimates. This being the only

Thomas Allen, print.

harmony restored, the succeeding Executive, relying upon the soundness of the principle upon which it was founded, again introduced to the consideration of Congress (to use his own language) 'the comprehensive scheme of roads and canals.'

"President Madison, in his annual message of the 3d of December, 1816, immediately on the restoration of peace, in enumerating the objects of general interest, says: 'I particularly solicit the attention of Congress to the expediency of exercising their existing powers, and, when necessary, of resorting to the prescribed modes of enlarging them, in order to effectuate the comprehensive scheme of roads and canals, such as shall have the effect of drawing more closely together every part in the common stock of national prosperity.'

"It is manifest, from the phraseology of that message, the Executive had direct reference to the comprehensive scheme of roads and canals which had been projected under the preceding administration. This portion of the message was referred to a select committee, who made an enlightened, and it might be added, *patriotic* report, in which the great valley of the lakes was particularly adverted to as the grand theatre upon which the General Government was destined at no remote period to act a distinguished part in effectuating one of the proudest schemes of internal navigation the world ever beheld. With such high authority before them, the committee felt that they would be justified in recommending the construction of this canal upon the authority of general expediency, as it is undoubtedly an object coming clearly within that class of cases; but, to clear it of all doubt, they have availed themselves of more recent decisions, sanctioned by every branch of the Government, that give them metes and bounds of constitutional authority.

"When the question of State rights, which had been settled by the famous resolutions of 1798, was reopened by the introduction of a protective tariff, various and conflicting opinions obtained in different sections of the country in regard to the true limits of the powers conferred on Congress over the subject of internal improvements. Objects similar to those over which Congress had, by common consent, exercised undisturbed jurisdiction, and on which it had expended vast sums of the public treasure, were now declared out of the pale of its authority.

"The necessity which some of the statesmen discovered, of drawing closer than ever the cords of strict construction, in order to defeat the scheme of protection, obliterated or defaced all the ancient landmarks which had hitherto guided the Government in this branch of its duty, and wholly suspended the operation of a system from which the country had already begun to reap some of its richest fruits, and mystified every rule and principle in relation to that branch of federal legislation. The fearful shock which the constitution received from the violence of these political concussions, staked its whole safety upon the event of mutual compromise and concession. An eagerness was manifested on all sides to establish some fixed rules by which the rightful powers of Congress might be judged. At the commencement of the late administration, the Executive furnished, by way of opinions expressed to both branches of the Legislature, a constitutional vocabulary, which was supposed to be based upon the literal grants of the constitution; the terms which it embraced were intended to afford a criterion by which every individual case might

be judged in deciding upon its constitutionality. Those opinions were contained in the annual message of the 7th of December, 1830; on examining which, it will be found that, so far as an object is designed for commercial purposes, it must have a connexion with the *foreign* commerce of the country. That this was the criterion which was attempted to be established in the message, is abundantly evident from the following short extracts.

"After alluding to the uniform practice of the Government in defraying from the public treasure the expense of building light-houses, light-boats, buoys, beacons, and public piers, on all the bays and harbors, as objects connected with the revenue and foreign commerce, it adds:

"'As our foreign commerce increased, and was extended into the interior of the country, by the establishment of ports of entry and delivery upon our navigable rivers, the sphere of their expenditures received a correspondent enlargement. Light-houses, beacons, buoys, public piers, and the removal of sand-bars, sawyers, and other partial or temporary impediments in the navigable rivers and harbors, which were embraced in the revenue districts from time to time established by law, were authorized upon the same principle, and the expense defrayed in the same manner.'

"The same sentiment was expressed more in detail in the veto message of 1832, on the bill making appropriations for the construction of harbors and the improvement of rivers. From this bill the Executive had withheld his signature, for the reason that some of the objects were of a local character. In the message he mentions the classes of cases which he deemed national, and therefore constitutional:

"1. Harbors on the seaboard.

"2. Navigable rivers below a port of entry.

"3. Harbors on navigable rivers and great navigable lakes."

This classification recognises distinctly a connexion with foreign commerce; according, then, even to this doctrine, is not the great project under contemplation most manifestly within the power of Congress? Have not the great inland seas a most intimate and direct connexion with our foreign commerce? This cannot be denied. Any work, then, having for its object the great design of increasing or rendering more secure that commerce, would surely come within the constitutional limit, as prescribed by General Jackson in the messages alluded to. That both of these objects will be promoted, will appear upon examining the remarks upon the *utility* of the work, which we now come to notice.

The completion of the Welland canal, extending around the Falls of Niagara, upon the Canadian side, was considered by most of our enlightened citizens, who had marked the progress of this improvement, more in the light of a *military* than a commercial enterprise. By means of this canal, vessels of war, for the purpose of actual hostilities or defence upon either of the great lakes, as contingencies might warrant, could pass from one to the other; thus concentrating at any moment the whole force, and avoiding the *expense*, trouble, and risk, of maintaining two distinct fleets upon these waters. It is only necessary, in order fully to appreciate the advantages thus secured, to advert to the scenes that transpired in this region during our late contest with Great Britain, and to trace the

vast frontier, studded with villages and cities, it would become necessary to protect in the event of a similar rupture. It is an old and true maxim of nations, that "in time of peace prepare for war;" and it may very properly be assumed, that the best guarantee a nation can possibly have for peace, is in her military strength, and in her ability to maintain and defend her rights. Hence we see a constant and vigilant jealousy exercised on the part of the European Powers, in regard to their respective movements; and any considerable accession of strength on the part of either is justly considered as fraught with danger to the preservation of peace, and the effect invariably counteracted by some corresponding movement on the part of the other Powers.

So long as a due equilibrium is presered, neither insult nor agression is very likely to be committed; nor will war follow upon every frivolous pretext; entirely, then, as a strictly defensive measure—a military precaution—is the construction of this canal warranted, in order to counteract the advantage, in case of hostilities, England would derive from the use of the Welland canal, as a channel for the transportation of troops and all the necessary and incidental attributes and munitions of war, it would prove of incalculable service, and supersede entirely the necessity of erecting forts and maintaining garrisons, at vast expense, at the innumerable important points along the line of this frontier. It is not to be questioned that the whole of this vast region of territory bordering on our great western lakes would, in the event alluded to, be liable to constant interruption and aggressions from the hostile forces, and the necessity thereby imposed upon the Government of fortifying and protecting the whole of this interesting portion of our country. The hostile forces could, by means of the Welland canal, at any moment be concentrated upon either of the lakes, and thus rendered doubly strong and effective. Sound policy, then, just a regard for the security of our frontier, and the preservation of peace, all unite in urging upon the national Legislature the great propriety, in a military point of view, of the construction of this stupendous work. The existing difficulties in Canada form no inconsiderable argument in favor of its *immediate* construction; for however unsuccessful to the insurgents this revolt may prove to be in the present instance, it is not to be disguised that such outbreakings are more or less liable to occur whilst the Canadas remain colonies of Great Britain; nor is it to be denied that such revolutions seriously endanger the pacific relations between this country and Great Britain. To illustrate this position, it is only necessary to recur to existing facts upon our northern frontier. Scenes are there daily transpiring of so hostile a character that the utmost energy and discretion of the two Governments is required to prevent an open rupture. The Welland canal may be said, virtually, to be closed to our citizens, and the interruption to an intercourse, commercial and otherwise, hitherto of the most friendly and beneficial nature, to amount almost to a direct prohibition.

It is but a few days since that armed soldiers were stationed at the several landings on either side of the river, allowing neither persons nor property to pass without a scrutinizing examination, and presenting throughout the Niagara frontier the appearance of one vast military camp. Under such a state of things our citizens cannot be expected to use the Welland canal even for commercial purposes; and should the

Canadian Government proffer its use ever so sincerely or freely, it is not to be supposed that such a proposition would be accepted, or that merchants or others would risk the passage of their property through a country embroiled in the horrors of a civil war. So long, therefore, as these difficulties exist, if not so long as there remains danger of their recurrence, this canal, as a channel of western trade, must be closed. Hence the importance of the immediate action of our Government, not only for the purpose of fostering, sustaining, and encouraging, the enterprise, industry, and trade, of her citizens, but also of strengthening her arms and means of defence, preparatory to the event of a foreign war.

The committee append document C, from the report of the engineer before alluded to, illustrating in a masterly manner the various military advantages to be derived by the Government from the construction of the Niagara ship canal.

If, as has endeavored to be shown, the completion of this vast national enterprise be of importance in a military and naval point of view, it will be found upon examination no less so in a commercial one. It is not necessary in this enlightened age to dwell upon the advantages, morally and politically, a nation constituted as this is derives from the extension of its commerce; and the obligation imposed upon Government, at all times, to extend to it its fostering care and patronage. The arts and sciences, morality, religion, and civilization, are all promoted by commerce, and may be said to flourish in the ratio that commerce is advanced.

In a country like ours, consisting of a number of distinct political communities, having in some degree separate interests, and extending over a vast extent of territory, inexhaustible in all the elements of wealth and enterprise, the cords of the Union will be strengthened, the happiness and interest of the people greatly promoted, by a judicious extension of its internal communications. The diversity of our soil, climate, and surface, and the corresponding diversity of its productions, begets an interchange of commodities, of reciprocal advantage. Any object, therefore, that shall increase the facilities by which this exchange or commerce is carried on, will have a direct tendency to promote the interests of the people, and render more intimate existing relations. Labor may be said to be the first source of wealth. To make that labor availiable beyond a mere subsistence, commerce is necessary, by which the surplus product of the labor of one section may be converted into the luxuries and comforts of another. All the varied interests of man, every species of enterprise and labor, are promoted by this system, and no opportunity should be neglected by any Government to extend its blessings to all practicable limits. The agricultural interest of this country is yet in a state of comparative insignificance, prosecuted more as a means of subsistence than as a resource to wealth. As our internal communications are increased, the great wealth of our agricultural regions will be developed, and the science of farming matured. Perhaps there is no section of the territory on the face of the globe, the soil of which is more fertile, or its mineral elements more abundant, than the great valley of the lakes. By opening this new artery upon the scale of magnificence recommended, a new impulse will be given to this entire section of country,

and one of its most obvious advantages will be the enhanced value of its real estate, which may always be said to be in the compound ratio of its productiveness and facilities to market. When an agricultural community has cultivated its lands to a state capable of supplying the home consumption, the improvements of the actual products will become stationary, unless made accessible to a foreign market; in which event cultivation may advance to an indefinite extent, or until the foreign demand is supplied.

There is no duty imposed upon a great nation more obligatory than that of affording its citizens every means within the scope of its powers of acquiring wealth and the comforts of life. This gives enterprise to its inhabitants, and, as a political axiom, it may be said that every people are prosperous and happy in proportion to the liberality and wisdom of the Government under which they live. The mode of government adopted by our fathers was thought best calculated to promote the welfare and happiness of the people. Any object, therefore, which has this great end in view, carrying out this great principle, it is incumbent upon the Government to perform. How better can this be done than by affording artificial channels of intercommunication? thereby promoting all the varied interests incidents to the country, harmonizing conflicting opinions, removing sectional jealousies, and imparting additional strength and stability to the Union. By such a policy, the remotest sections of country are made productive, and every portion of our soil rendered subservient to the ends designed by the great Creator. There is no enterprise, perhaps, that could be gone into, that would produce results equally beneficial with this: as there certainly is no territory of equal extent more capable or worthy of physical improvement than that bordering upon and contiguous to our great inland seas. As before observed, its soil is of unsurpassed richness, its local advantages sufficient for all manufacturing purposes, and in mineral productions exhaustless.

What can be done to improve the moral, social, and political condition of a country, and enhance its wealth by means of artificial channels? Let the history of this country and that of Great Britain for the last thirty years answer. Nay, in Great Britain, we will go still farther back, and, by a reference to her history for the last sixty or seventy years, we shall find that the construction of her artificial roads and canals have contributed, in a most eminent degree, to the development of her wealth and resources, and to her present proud elevation as a great and powerful nation. In our own happy country we are by no means destitute of examples showing how much we are indebted to this species of enterprise for the rapid and unparalleled advances of the United States in wealth and population. Look at the great Erie canal, in the State of New York: a monument of the wisdom and enlightened policy of its distinguished champion, as permanent as the hills and valleys through which it passes. Look also at the Erie and Ohio canal, in Ohio, and for one moment contemplate the effect of these improvements upon the western country. It cannot be denied that these two canals alone have done more than all other causes combined to advance the wealth, population, and enterprise, of the western States, to enhance the value of the public lands, and contribute to the surprising rapidity of their sales.

Let not the existence of the Hudson and Erie canal in New York form

any argument against the construction of the one under consideration. The present project is demanded to give new impetus to the march of enterprise and develop new resources. Those who would now argue against this measure, because the Erie canal affords sufficient facilities for getting the products of the country interested to market, would have, with equal propriety, argued against the original construction of that canal upon similar grounds. The products of this region will increase in proportion to the increased facilities for carrying them to market, until, indeed, the maximum of improvement shall be attained; an event scarcely within the scope of imagination. What a harvest England is reaping from her wise system of internal improvements, to which she is indebted, in no inconsiderable degree, for the flourishing condition of her commerce, agriculture, and manufactures. That the same system will produce equally beneficial results to this country cannot be questioned. Indeed, there is no country in the world where this system can be so conveniently and advantageously prosecuted as in this, or where the outlay would yield so great an income. All those who are sceptical upon this subject we would seriously invite to trace upon the map the immense tract of country, comprising an area of 170,000 square miles, that would be thus made tributary to the great aggregate of national and individual wealth. Long since has Great Britain appreciated the importance of securing the trade of this vast and fertile country, and with much vigor and energy has she prosecuted, in her Canadas, to successful completion, extensive works of internal improvement. It is with no feelings of jealousy that the committee advert to her liberal enterprise; her extensive system of intercommunication is the fruit of that liberal view of public policy which ever characterizes a great and powerful nation. She has not neglected the favorable opportunities, afforded in a state of peace and plenty, to prepare for war; and equally mindful has she been of her commercial interest, not having failed to avail of every means, physical and moral, so to improve her own navigation as to intercept, in a measure, the trade of the western States, and draw it into her own ports. By the Welland canal, a communication is open between Toronto and the upper lakes; the Rideau canal, built at the vast expense of six millions of dollars, although only 126 miles in length, connects lake Ontario with the Ottawa river; the La Chien, Carrillon, Blandeau, and Grenville canals, complete the entire route to Montreal. In addition to these, a canal is now in progress of construction around the rapids of the St. Lawrence, which, when completed, will open a direct ship communication with the mother country. It requires no stretch of fancy, nor can it be said to be a visionary speculation, to look forward to the no distant period when the ports of Oswego, Lewiston, Buffalo, Cleveland, Detroit, and Chicago, will be studded with the canvass of the ships of foreign nations laden with the rich productions of Asia and Europe.

It is well established, both by theory and experiment, that in canal navigation the expense of transportation is in the inverse ratio of the size of the vessel in which the commodity is transported; therefore, in the construction of canals, it is desirable, in point of economy, to give them that width and depth which will enable them to float the largest class of vessels. By way of illustrating this proposition, a statistical account of the comparative expense of transportation from the city of New York to Detroit, by the way of Oswego and the Welland canal, and

by the way of the canal through Buffalo, is appended. The Oswego route substitutes the lake vessels instead of canal boats, and cuts off about two hundred miles of the Erie canal. From an estimate before the committee, it appears that in 1835 about 25,000 tons of merchandise was shipped from the city of New York west, passing through the ports of Oswego and Buffalo, four-fifths passing the latter place. "Had the whole of this passed either port, it is ascertained that the different rates charged from the different ports would have left the result in favor of the port of Oswego, as follows :

Freight of 25,000 tons via Buffalo, - - -	$600,000
Freight of 25,000 tons via Oswego, - - -	335,000
Amount saved by the Oswego route, -	$265,000

in the transportation of merchandise from New York to Cleveland, Ohio, in one year."

The cost of construction of this splendid work will vary from two to four millions of dollars, according to its location and extent; a sum comparatively of small amount when the immense advantages to be derived from this great enterprise are taken into consideration. It is confidently believed that it would save to the western States annually, on the transportation of merchandise alone, full half its cost, and operate most beneficially in enhancing the value of public and private lands. In the manner of constructing this canal, the committee have adopted the recommendation of the Hon. John C. Calhoun, while Secretary of War, leaving its execution to the War Department, under the direction of the President, from whose report the following extract is taken :

"Should Congress think proper to commence a system of roads and canals, for the more complete defence of the United States, the disbursements of the sums appropriated for this purpose might be made by the Department of War, under the direction of the President. When incorporated companies are already formed, or the road commenced under the superintendence of a State, it would be, perhaps, advisable to direct a subscription on the part of the United States, on such terms and conditions as might be thought proper. In other cases, and when the army cannot be made to execute it, the work ought to be done by contract, under the superintendence and inspection of officers of the engineer corps, to be detailed for that purpose."

As to the plan and contemplated dimensions of the proposed work, the committee again refer to the report of Captain Williams, upon the files of the House.

Influenced by the foregoing considerations, as well as by many others which have been suggested to the committee, they concur in the frequent recommendations of this project, and therefore respectfully ask leave to introduce a bill.

A.

WAR DEPARTMENT, *April* 14, 1836.

SIR : I transmit, herewith, a report of the Topographical Bureau, prepared in obedience to a resolution of the House of Representatives of the

3d ultimo, calling for information respecting the construction of a ship canal, to connect the waters of Lake Erie and Lake Ontario.

Very respectfully, your most obedient servant,

LEWIS CASS.

Hon. JAMES K. POLK,
Speaker of the House of Representatives.

TOPOGRAPHICAL BUREAU,
Washington, April 13, 1836.

SIR: I have the honor to submit, herewith, a copy of the report, plan, and estimates for the construction of a ship canal, to connect the waters of Lake Erie and Lake Ontario, made during the year 1835, under the direction of Captain W. G. Williams, United States topographical engineer, and called for by a resolution of the House of Representatives of the 3d of February last.

I am, very respectfully, sir, your obedient servant.

JOHN J. ABERT,
Lieutenant Colonel Topographical Engineers.

Hon. LEWIS CASS, *Secretary of War.*

Report of a survey around the Falls of Niagara, with a view to the construction of a ship canal, made during the year 1835, *under the direction of Captain W. G. Williams, of the United States topographical engineers.*

WASHINGTON, *March* 17, 1836.

Lieutenant Colonel J. J. ABERT,
United States Topographical Engineer:

SIR: By the letter from the Topographical Bureau, under date of the 14th of April, 1835, I was ordered to repair to Utica, in the State of New York, and advise with the Honorable Mr. Beardsley on the subject of a projected ship canal around the falls of Niagara; for a survey of which, application had been made to the Department by certain gentlemen of influence in the State of New York.

Lieutenants Drayton and Reed having reported to me according to instructions, with the instruments necessary to accomplish the objects of the survey, I immediately commenced operations; the details of which, with results, and all that relate thereto, are embraced in the following report:

In order that the mind may be more prepared to comprehend, at a glance, the various details in regard to several lines of survey therein referred to, I think it proper to premise a cursory topographical sketch of the vicinity in which our operations were conducted.

Topographical sketch.

The section of country to which the project of the Niagara ship canal relates, is perhaps the most interesting on the American continent, whe-

ther we consider its geological formation, the incidents of a frontier war, still fresh in the memory of every American, or its peculiar and magnificent characteristic, the cataract, whose fame has reached the uttermost bounds of the civilized world.

The great waters of our northwestern possessions, covering an area of 150,000 square miles, bounded by a development of coast, belonging to the United States, of 3,294 miles, and of the British colonial possessions, of 2,425 miles, are at length discharged through the narrow channel of the Niagara. It is from the head of this river, at the outlet of Lake Erie, to its termination on Lake Ontario, that the question of an artificial navigation arises, and forms the subject of the present report; and, if only to achieve a conquest over the mightiest of nature's works involves a sentiment of sublimity, the feeling will not be impaired by the reflection that the conquest may be easily wrought; and, when achieved, shall be the means of extending civilization, and promoting the social happiness of a large proportion of our country.

Indeed, it cannot fail to excite astonishment, when the reflection is once led to the subject, that, up to this epoch of an age resplendent with improvements in all that relates to the melioration of commerce and the advancement of civilization, this work, upon our own soil, and on a scale commensurate with its importance, should still remain to be executed. It needs not the aid of demonstration to prove its utility. It is one of those objects that strike us with instinctive conviction, and we are intuitively impelled to the belief of its comprehensive usefulness, even if abstraction be made of every thing but the general position; that it would connect two bodies of water, leading to the most remote regions, and capable of bearing upon their deep and expansive bosoms the navies of the world, in five seas, which are yet essentially separated, by reference to the scale of commercial enterprise that legitimately belongs to such a vast extent of geographical limit.

The Niagara river flows out of Lake Erie, in a direction nearly north, and separates in its whole course the United States from the Canadian provinces. It is about three-fourths of a mile wide, at its outlet; between which and Black Rock there are rapids having a current for a short distance of seven miles an hour. The river widens below Black Rock, and continues of an average width of one mile, until it reaches the great falls. The river embraces several islands in its course, the principal of which is Grand island; the rapids commence about one mile above the falls, in which distance is a descent of about fifty-two feet. The great falls are divided by Goat island, and another small island intermediate to this and the American shore. The perpendicular descent is 164 feet on the Canada side, and a few feet more on the American; but the great mass of water passes over the Horse-shoe falls on the Canada side. It has been estimated by Dr. Dwight, that the volume of water descending at this point amounts to 90,000,000 tons per hour.

The development of the curve formed by the edge of the precipice is estimated between three-fourths of a mile and one mile. The distance from the outlet of Lake Erie to the great falls is about twenty-two miles. From this point to Lewiston, about seven miles, the river rushes through a chasm in the Lewiston ridge, whose edges are about 350 feet above the surface of the water; the fall in this distance is about 103½ feet, and thence to Lake Ontario two feet. Just above Lewiston the high ground

suddenly ceases, and a descent of 216 feet occurs in a horizontal distance of 1,000 feet, measured on the projection of the line of greatest acclivity to the ridge. This brings us to the plateau of land on which the village is situated; hence a gradual slope characterizes the ground to the edge of Lake Ontario, about six miles, comprising a fall of 121½ feet. The features of topography on the opposite side of the Niagara are very similar, from the crest of the mountain at Queenstown heights to the lake.

The ridge appears to have been formerly continuous, and to have formed the southern edge of Lake Ontario, from which the waters have, at distant intervals, receded. This is shown by three distinct berms, generally parallel to the shores of the lake, but which eventually converge towards the Niagara river, between Lewiston and Fort Niagara.

It is evident, also, from the conformation of ground both at the falls and about Lewiston, that the waters of the upper lakes first burst their barriers at this point, and have since receded by degrees, breaking off large fragments from the edge of the precipice over which they have fallen. Even within the memory of man, it is asserted that a sensible difference exists in its configuration; and the fall of the Table rock, in the years 1818 and 1828, may be regarded as an illustration of the process by which this change is being gradually effected. If we may be allowed to speculate on the changes of a remote future, we may imagine prospective eyes to witness a gradual recession of the cataract towards the lake; the crest over which it falls, assuming a lower plane, until it eventually sinks to, and becomes an element of, a general slope, over which the great volume of the upper lakes shall flow. The waters of Lake Erie would recede from their existing limits, and their intermediate future outlines would be only indicated by successive berms, converging towards the outlet of the Niagara. This convergency of the several berms to the Niagara river, on the southern shore of Ontario, is, I think, a conclusive evidence that this lake once occupied a higher level, and and at different periods has occupied different elevations. In tracing these changes, we are insensibly led to the conclusion, from analogous reasoning, that the levels of the whole chain of lakes will eventually and successively change; that the St. Lawrence river may, in remote ages, have possessed a peculiarity similar to that which characterizes the Niagara; and that a point of time may exist in the vista of futurity, when the strait between Erie and Huron, and finally between Huron and Superior, may boast a like phenomenon. In a word, that this will, at length, be worn away by the irresistible waters, and Superior find its way over one continuous and inclined plane to the broad bosom of the Atlantic. At the outlet of the Niagara, at the northeast extremity of Lake Erie, is situated Buffalo. This city, which a few years since might have been regarded as an insignificant village, has now become the principal emporium of the northwestern lakes, and cannot fail to retain its ascendancy over any other point upon the lake. Here the Hudson and Erie canal, which has been the source of its prosperity, has its outlet. The growth of Buffalo is an illustration of the advantages of this project, that every comprehension may realize. When we see a flourishing and refined community spring suddenly from the wilderness, we are made sensible, without reference to statistical records, of the amelioration that

must be operating in a vast extent of country dependent upon it. It is a monument to art and commerce, that eloquently speaks of extended social happiness, of fields reclaimed from the desert, of industry and talent usefully employed, and of a thousand undefinable benefits to the human race.

The Hudson and Erie canal is conducted from Buffalo, along the margin of the Niagara river, to its intersection with the Tonnewanta creek, a little above its mouth, the creek being raised to the necessary level by means of a dam. The channel of the Tonnewanta is made use of during a distance of eleven miles, to Pendleton village; thence to Lockport, about seven miles, the canal passes through deep cutting. At Lockport a fall of sixty feet occurs, which is overcome by five double consecutive locks to the long level; from this point it proceeds in an easterly direction to Troy and Albany, where it debouches into the Hudson river. From Lockport, the line upon which a portion of our survey was conducted diverges northwardly to its termination at the mouth of Eighteen-mile creek.

The great descent at Lockport is occasioned by the Lewiston ridge, which intersects the canal at this point. This steep declivity runs from the Niagara river, above Lewiston, to Lockport, without any intermediate depression worthy of notice. It continues its course thence in a direction nearly parallel to the lake.

The ridge, as it becomes more remote from the Niagara river, generally becomes more elevated, to the limits to which my survey extended. The whole of this district of country is based upon nearly horizontal strata of lime and sand stone alternating; this exhibits itself most conspicuously in the chasm through which the Niagara flows; although, it must be remarked, that localities exhibit discrepancies in regard to this rule, and that, on the line of canal from Lockport, west, there is some slight inclination of the strata beneath the horizontal. The first proposition, however, holds as a general geological feature. The slope below the ridge, down to the lakes, appears to consist of an alluvial formation, with a substratum of sand and lime stone. From the foot of the combined locks at Lockport to the mouth of the Eighteen-mile creek, which has its rise at this point, the ground is very uneven; at first a considerable descent takes place through a precipitous gorge for about two miles; thence, a valley with low banks on either side for about five miles and a half; the intermediate distance between this and the mouth of the creek would be a work of considerable difficulty, as there is a rocky bar which circumscribes the outlet. From this point to the mouth of Niagara river is eighteen miles; from which circumstance the creek derives its name.

From Fort Niagara, at the east side of the outlet of Niagara river into the lake, to the head of navigation, is about 7½ miles; the banks of the river in this distance are high and precipitous. The river, from Lewiston to its outlet into the lake, has a rapid current, but is accessible to every description of vessels navigating the lakes. This description comprises the area to which my report will refer. In its agricultural properties, it partakes of the character of this section of the country generally, possessing a rich alluminous soil, favorable to the growth of wheat and every product to which the climate is congenial; but there is one point of view in which this district offers advantages in a peculiar degree;

namely, its manufacturing facilities. By way of illustration, we may regard the lake as being dammed by the Lewiston ridge, presenting a head of water of three hundred and twenty feet. This may be made available at almost any point of the ridge, and along the margin of the Niagara river, at a comparatively inconsiderable expense, by reference to the hydraulic power it would afford. My views in this respect will be further elucidated in the course of my report. I now proceed to details immediately referring to the plans and estimates of our survey.

Plan of canal.

The project under consideration contemplates a ship or steamboat canal; and we assume, for dimensions of locks and breadth of canal, proportions to render the work a means of transportation for the larger class of steamboats or sail vessels navigating, or that may navigate, Lakes Erie and Ontario.

We assume for the length of lock two hundred feet, breadth fifty feet, the width of canal one hundred and ten feet at the surface of the water, and depth ten feet. The locks will have a lift varying with circumstances, and generally not exceeding ten feet. It is obvious that the waters to supply the exigencies of lockage, &c., will be drawn from the Niagara river; the plane of the bottom of canal at its summit-level intersecting it at ten feet below its minimum elevation.

My plan principally refers to a system of double locks to make the descent at Lewiston ridge; but an estimate for single locks for that object is embraced in my report. Map No. 2 will exhibit, on a horizontal scale of thirty-six inches to one mile, the descent by double locks, comprising an artificial harbor at Lewiston.

From the harbor to the outlet of canal on Niagara river, two modifications are shown on the map; one terminating at the steamboat wharf, and the other at the ferry. Their expense may be regarded in a general estimate as nearly alike.

The line A B, debouching at a lower point of the river, although of greater development, would more generally be approved of, as avoiding an ascent against the current, for ascending vessels, of eleven hundred yards.

I have roughly estimated also the cost of a plan to descend the ridge by single locks, having an intermediate basin between each lock. It is found to be more expensive than the descent by double locks, by reference to their respective properties of speedy transit. This arises from the great cost of the outer or sustaining wall, and the advantage to economy of diminishing the length of line in its application to the side slope of the mountain; as this must be obvious, I have not introduced the estimate into my report.

In regard to the route of the contemplated canal, there have been different opinions; and several have been designated, having at least as much reference to local interest as to the general advantage of the project. Above the rest, and such as appear deserving of notice, are:

A line beginning at Porter's storehouse, near old Fort Schlosser, passing by Fort Grey, descending the ridge at that point, and debouching at Lewiston: this is the shortest line surveyed.

A line beginning as above, passing by Manchester village, and intersecting the preceding line : this has least deep cutting.

A line up the valley of Gill creek, descending the ridge through a depression at the head of Fish creek, and terminating on Lake Ontario, at he mouth of Mill creek : this location possesses advantages of a military character, by reference to the contiguity of the shore of a foreign Power.

Local modifications of the above lines.

A line ascending the Cayuga creek, crossing the Lewiston ridge near Pekin, and debouching at the mouth of Twelve-mile creek.

A line debouching at the mouth of Tonnewanta creek, ascending the same to Pendleton village, descending at Lockport into Eighteen-mile creek, and keeping the valley to its mouth.

For the present, however, we shall confine ourselves to the investigation of the project by its shortest route, and eventually compare it with others to be hereafter referred to.

General description of route line No. 1.

Beginning at a point on the Niagara river denominated Porter's storehouse, and near old Fort Schlosser, the line of levels crosses Gill creek at a distance of half a mile above its mouth, and is carried nearly in a straight line to the head of Bloody run ; the ground over which they pass, after the first mile, is generally swampy, although somewhat elevated ; and for the first four miles, as determined by careful borings, no rock worthy of mention will occur, excepting a small portion at Gill creek ; the soil is, however, by no means easy of excavation, being, as illustrated by the profiles, in some parts of a tenacious character ; the ground is swampy, covered with a heavy growth of timber, and will require draining.

From this point, the valley of Bloody run is pursued to within a short distance of the point where the run falls over the precipice into the Niagara river, at a small distance from the chasm known as the Devil's hole, three and a half miles below the great falls.

The levels now pass over unequal ground, but slightly elevated, however, until they reach the brow of the Lewiston ridge. This portion of the line was run very near the precipitous brink of the Niagara river, and only involves a prism of rock cutting of inconsiderable depth.

Until we arrive at Fort Grey, no obstacle of importance intervenes ; indeed, none but the most commonplace circumstances of canal construction present themselves. It is from this point to the debouch of the project into the Niagara river that difficulties of a serious character may be apprehended.

From the brow of the ridge the lines of level were carried obliquely to the line of greatest acclivity of the ascent, falling in such proportion to the measured horizontal distance, as to render them conformable to the projected dimensions of the locks and basins, with the required lift for each lock. These data furnish the means of projecting a flight of double consecutive locks to the foot of the ridge, or a line of single locks, with intermediate basins ; involving, in either case, a descent of 319½

feet from the bottom of the canal at Fort Grey, to the corresponding surface at its intersection, ten feet below the surface in Niagara river.

As the slope of the mountain may, in a general view, be regarded as uniform, and under an angle too great to admit of the location of the locks on a line approximating to that of greatest acclivity, it would be necessary, by means of excavation and embankment, to prepare a berm for their reception.

Our supposition involves a heavy mass of side-cutting, so as to establish the exterior walls of the locks upon a well-consolidated foundation; by this means, the whole section of the locks and basins would possess a homogenous basis, and have their stability ensured.

This excavation comprehends the space to be occupied by the sustaining and interior walls; and in case the double locks should have their similar surfaces in the same horizontal plane, the breadth of their dividing-walls would be comprised in the section.

In estimating the width of the berm necessary to the emplacement of the locks, we must regard as elements the strength and solidity or thickness necessary to their walls, to prevent lateral slides, or their overthrow by the pressure of water against them from within; and the space necessary to the working of the locks, which must of course occupy the upper surface of the walls. Precautions must be observed, to destroy the possibility of a thread of water from leakage or filtration, wearing itself a passage beneath the locks, throughout portions of the descent, and thereby acquiring sufficient head to act upon the foundations. In a system of consecutive locks of such extent as that before us, this principle of hydrostatics should be well considered.

Too much care cannot be observed in establishing the permanence and solidity of the work; and every applicable element of knowledge, theoretical as well as practical, must be brought to bear upon the subject, previously to a final adjustment of the plans.

In regard to experience, the realm of practical science does not exhibit a similar construction, and its light will therefore be but partially displayed. To compensate for this deficiency, abstract and general propositions of physical research must be carefully investigated, in reference to such modifications as may be involved, differing from those of works of a similar character already constructed.

This is a remark, it is true, that may be applied to every new project in some degree, but its emphasis is peculiar in regard to the one in question: in ordinary cases, great masses of water find their way to lower levels, by gradual descent; and the plans of the engineer to surmount such obstacles have followed them up and vanquished them in detail. But at Niagara, Nature has concentrated her powers, and by one stupendous effort has seemed to bid defiance to the art of man. The records of science do not exhibit an instance in which so great a fall is overcome in so small a distance, not even in a degree that will admit of comparison, much less when it is a question of a project which, in the grandeur of its proportions, has no example.

It may be regarded as a national monument of art, from its general usefulness to the country; and although no pains be taken to render the project magnificent, in its very simplicity it will be so, and in congeniality with the stupendous obstacle it is intended to subdue.

Its effect will be grand and imposing in a vastly greater degree than in other, even more expensive works; because it differs from them generally in possessing a concentration of human art, human industry, and physical means, applied to a single point.

As the line of levels descends to the foot of the ridge, it gradually winds round until its horizontal projection becomes nearly parallel to its location at the beginning of the descent.

In order to obtain the direction which leads it to the most favorable point of debouche on the Niagara river, for the present modification of our project I have planned a basin allowing sufficient room for the largest vessel admissible to the locks to turn and assume its change of course. At this point the flight of locks would terminate in an extensive artificial harbor, comprising an area of about 114 acres, and elevated 120 feet above the level of the Niagara river; it will be formed between the ridge on which the principal street of Lewiston is situated and the main ridge, possessing a mean depth of fourteen feet. The embankment necessary to back the water would be very inconsiderable.

It is an element forming a very important feature in our project, and would have the advantage of serving as a part of the canal, obviate a mass of expensive construction, and at the same time afford very essential accommodation to trade; indeed, a basin of this kind would be almost necessary, by reference to the very contracted space which can be made available for the purpose of commercial transactions in the vicinity of the debouche, in connexion with the precipitous banks of the river and the violence of the current; moreover, the prism of water drawn from this reservoir, to supply the descent of the locks to the termination of the project, would be scarcely perceptible. This would render the descent from the harbor to the outlet independent, for its immediate exigencies, of the supply of water to be drawn through the upper flight of locks from the summit-level of the project.

At both extremities of the line above described, there is a navigable passage for vessels drawing even more than ten feet water into the lakes, namely, from Porter's store-house into lake Erie, and from Lewiston to lake Ontario.

To confirm the assurance of this fact, I ordered a reconnoissance between Schlosser's and the outlet to lake Erie. Numerous soundings were taken by Lieutenant Drayton, from whose report I find there is no depth in the channel less than fourteen feet.

It is a matter of notoriety that there is water at the outlet of Niagara into lake Ontario for vessels of any ordinary capacity. It was therefore deemed unnecessary to carry the investigation to that point.

On the whole extent of this route may be procured fine building materials for the locks, of every description: limestone is found in abundance, and hydraulic cement may be procured at a low rate.

These facts being premised, I proceed to the estimative details.

Line No. 1.—*(See map and profile.)*

For the purpose of draining the canal when necessary for repairing it, and because there is a rise and fall, dependent upon winds and seasons, in the Niagara river, a guard and regulating lock at the outlet of the ca-

nal is deemed expedient. Our observations during the time the survey was executing only detected a difference of level of five inches. By information, however, obtained on the ground, it appears to be considerably greater ; and, according to the statement of Mr. Geddes, an engineer well acquainted with the topographical facts connected with this section of the country, it varies to the amount of three feet, rising during the prevalence of certain violent winds, but seldom being depressed below the ordinary surface. Our levels refer to the lowest observed plane of its surface, at a time when the level is stated to have been at a minimum.

The lock-walls, therefore, must be elevated four feet above the minimum level of the river. They will have a thickness of four feet at top, and eight feet at the base. The dividing-wall of lock will have a thickness of twelve feet. The estimate is as follows :

6,150.8 cubic yards of masonry for side-walls, bottom of lock, &c., at 5.5	$33,829 40
For mitre-sills, hollow quoins, at 14.2	8,657 00
Lock-gates, with incidental work	1,500 00
200 running feet of walling in river, 444 cubic yards, at 2.5	1,110 00
Coffer-dam, to protect the foundation of the lock	6,666 00
Contingencies	5,176 24
Total	$56,938 64

The plan to which this estimate refers is an element common to all the experimental lines diverging from Porter's store-house, and will be carried into the expenses of each. It embraces the idea of double locks, with such additional work as may contribute to a reasonable accommodation to trade. At a termination of this kind, many expensive additions may be suggested, not absolutely necessary to the primary object of the undertaking.

B.

Comparison of routes.

The annexed summary of cost, applied to its respective experimental location, in connexion with the statement in regard to distances, enables the mind to form, at a glance, the comparison between them, by reference to these elements. But in order that a judicious selection may be made, other considerations necessarily become involved in the question ; and these, in a great measure, furnish the medium through which their properties are to be adjudged.

As a commercial scheme exclusively, with the most rigorous economy as the governing principle, even to the prejudice of convenience of trade, and barely to effect the object of connexion between the lakes for a large class of vessels, the first plan referred to in the annexed statement would of course be adopted.

If this scheme, however, involved the idea of an expenditure proportionate to the character of the enterprise, and importance of the results

that may be justly ascribed to it, we would, without hesitation, recommend the second, namely, the descent by double locks; for it is evident that in the first proposition a great delay would frequently occur in the passage of vessels—an evil that would accumulate with the increase of trade, and result eventually in the necessity of constructing another independent flight of locks. This, by a comparison of estimates, is shown to be inexpedient.

But when the question passes beyond the limit of commercial operations merely, and enters the sphere of political expediency, new considerations are involved, tending, very generally, to embarrass a decision. It was this reflection that induced me to survey the line No. 2, as I have already explained, in presenting the estimate of its expense. In doing so, moreover, I, perhaps, have said all that is necessary, in regard to its advantage over the preceding line No. 1, and its modification.

In discussing the merits of the modification to line No. 2, the question is resolved into the following proposition: whether it be desirable to expend an additional million of dollars, as a measure of precaution, to enable the work to reach a point E, (map No. 1,) whence it could easily be conducted, in case it should be deemed advisable, to the lower lake, and be, in its whole development, without the pale of annoyance from an enemy. It is for those who should determine to execute the work to judge of this expediency.

We would call the attention, however, to the character of permanence and durability that must belong to such a project, and suggest that the future interests of the country are to be, in a measure, dependent upon it, and that it would prove a humiliating and grievous reflection to after-times, should the work be suddenly neutralized in its advantages, at the very moment when its facilities ought to be most sensibly useful to the nation.

To develop all the considerations involved in this comparison would exact more time than I am permitted to devote to it. It is sufficient to show that a route possessing the property of security from insult is practicable, and at a reasonable cost to the nation.

But the comparison between the Lockport route, and the one I have just alluded to, may be referred to the common standard of military expediency.

It is seen, by reference to the foregoing statement of costs and lengths of location, that the route by line No. 2 has the advantage, in point of economy, to the amount of $296,743 over that by Lockport. We see, likewise, by reference to this statement, and the respective maps accompanying my report, that it possesses the advantage of being a shorter and less embarrassed line of communication.

Its supposed advantages have been predicated upon the belief that it offered a more retired line of communication from foreign aggression; and this is a maxim that ought not to be overlooked: but in the present instance it admits of modification, owing to the peculiar features of topography characterizing the vicinity to this portion of the line of contact of the two countries.

By reference to the map, it will be seen that from Porter's store-house to the end of line No. 2, on lake Ontario, our shores are precipitous, and offer a difficult barrier in any part to the landing of a hostile force; and

that with the precaution growing out, as it were, of the project, should it be executed, as explained in the accompanying memoir, the line would be rendered inaccessible.

We are impressed with the belief that we should avail ourselves of the topography of the frontier, and, regarding the Niagara river, from Porter's store-house to lake Ontario as a natural entrenchment, concentrate our resources there, as furnishing the strongest accessorial advantages to resist invasion, and at the same time enable us promptly to assume the attitude of aggression under auspicious circumstances, and to the achievement of the most important results.

By retiring the line, we abandon, in a measure, our strong ground of resistance, and throw it from beneath the shelter of our military establishment already constructed at the mouth of the Niagara river, by which the debouche of line No. 2 would be sustained.

It is seen, also, in comparing the two routes, that one portion of navigation would be common between them, namely, that between lake Erie and the mouth of Tonnewanta creek; and this portion is unquestionably the most accessible part of the line to a hostile descent from the opposite shore.

In addition to these considerations, the project of line No. 2 supposes an excellent harbor at its termination on lake Ontario, while that projected at the mouth of the Eighteen-mile creek is comparatively inefficient; observing, at the same time, that the rocky bar circumscribing its mouth must ever prove an obstacle to its improvement.

Moreover, the contiguity of the inlet of the Niagara river to the mouth of Four-mile creek, our projected termination, is a great desideratum, as vessels in stress of weather may run, without apprehension, for the harbor there, in the assurance that, in case of difficulty to effect an entrance, they will be at least in the vicinity of a harbor of easy access, where they may take refuge until more seasonable weather.

It must be noticed, in regard to this subject, that any artificial harbor on this shore of the lake would be difficult of access in very heavy storms, owing to the danger of concussion against the sides of the piers; an inconvenience I have often noticed at the celebrated artificial harbor of Ramsgate, in Kent, England.

Superadded to the objections already stated, in regard to the route by Lockport, there is one important circumstance in the inconvenience and delay that the navigation on the present Erie canal would be subjected to, and we think that the loss sustained by it would scarcely be compensated by the diminution in the expense of our estimate, by the deduction we have made, in the assumption that the excavation for our present project would be diminished by the amount of that already executed for the Erie canal.

In the supposition of an entire new location, the estimate would, of course, be greatly augmented, and the difference of cost in favor of line No. 2 proportionably increased.

It is to be noticed in the line No. 2, that a portion of its development has a diminished breadth. This advantage, for the economy of excavation, could not be adopted on the Lockport route. In the first case, business would be divided between the two canals; but in the other, it would necessarily be concentrated, and embarrass the operations of trade, unless it should possess a breadth equal to that we have projected.

In order to fully prepare the undertaking for the contingency of a rupture with our Canada neighbors, it would be necessary to pass the rapids of Black Rock by a short cut and a few feet of lockage on the American shore. As the channel of the Niagara river is, in this part, on the Canada side, this modification applies equally to either route compared, and may remain as an item for future consideration, the expense being regarded as inconsiderable.

A plan, indeed, has occurred to me by which the whole of this accessible portion between Buffalo and the mouth of Tonnewanta creek might be somewhat more retired and more easily protected. The expense of this work would be, of course, somewhat greater. Let the canal commence at Buffalo, and carry the level of the lake, as nearly as may be admissible, along the valley of the Niagara river, as far retired from its margin as the nature of the topography will permit, to the mouth of Gill creek, ascending the valley of this stream to the head of Fish creek, as per line No. 2, and thence descending to lake Ontario. By this means we save a very considerable prism of rock excavation, and thus compensate, in some measure, for the greater length of the canal. This prism would be proportionate to the elevation that lake Erie may possess over the level of Niagara river, at our point of beginning, near Porter's store-house.

The plans, maps, and profiles, accompanying the present report, are as follows:

General topographical map, Lewiston line—No. 1.

Plan of location for descent of ridge, artificial harbor, and section of lock—No. 2.

General topographical map, Lockport line—No. 3.

Map of harbor at mouth of Eighteen-mile creek—No 4.

Profile line, No. 1.

Profile line, No. 2.

Profile line, No. 3.

Profile line, No. 4.

Profile line, No. 5.

These comprise all the various data obtained in the course of our examination; and will, I hope, when collated with my report, satisfactorily illustrate the subject under consideration.

In the course of my duty I have been assisted in the field, and in the various incidental calculations connected with the survey, by Lieutenant T. F. Drayton and Lieutenant J. G. Reed, United States army; and I do not regard it as an empty form to express to them, through the bureau, my acknowledgments for the very assiduous and efficient attention they have bestowed upon every minutia of duty intrusted to them.

Lieutenant E. B. White, United States artillery, and Mr. G. W. Featherstonhaugh, jr., United States civil engineers, have likewise assisted, very essentially, in the drawings and calculations that have been involved during the progress of my report—having been attached to my brigade since the close of our field duties.

Of the preceding lines, we will assume the five following as the best basis on which to institute a comparison by reference to their fitness for the proposed project:

	Cost.
Line No. 1.—Shortest route from Porter's store-house to steamboat wharf, or ferry, at Lewiston, by single locks - - -	$2,568,899 36
Do. by double locks - - -	3,610,596 21
Line No. 2.—From Porter's store-house by Gill creek and Four-mile creek, terminating on lake Ontario - - - -	$4,616,423 47
Modification of line No. 2, as above, and terminating at Lewiston, passing through artificial harbor	$4,744,982 88
Line No. 5.—By Eighteen-mile creek, Lockport, and Tonnewanta creek - - -	$5,041,725 48

Lengths of lines Nos. 1, 2, 3, and 4, together with their "modifications," included between Porter's store-house and Lewiston, and Porter's store-house and mouth of Four-mile creek.

	Miles.	Feet.
Line No. 1.—From Porter's store-house to Queenstown ferry, by way of Bloody run, Devil's hole, and Fort Grey, descending mountain by double and consecutive locks - - - - -	7	4,040
Line No. 1.—From Porter's store to "steamboat wharf," at Lewiston, descending mountain by single locks	8	3,660
Line No. 1.—From Porter's store-house to "Queenstown ferry," at Lewiston, descending mountain by single locks, principally - - - - -	8	3,180
Line No. 4.—From Porter's store-house, by "New Manchester," to steamboat wharf, at Lewiston, following the valley of Fisk creek, and descending mountain through depression at Miller's sulphur spring - - - - -	9	5,230
Line No. 3.—From Porter's store-house, by New Manchester, to steamboat wharf, at Lewiston, descending the mountain at Fort George - -	10	2,400
Line No. 3.—From Porter's store-house, by same route, but terminating at Lewiston, at Queenstown ferry -	10	1,920
Line No. 2.—From Porter's store-house to mouth of Four-mile creek, following the valleys of Gill and Four-mile creeks, and descending mountain through depression at Miller's sulphur spring -	14	5,000
Modification of line No. 2, by diverging at C, at foot of second berm, and following it westwardly to D, where it debouches into artificial harbor - -		5,120

C.

Military and commercial memoir.

In regard to general considerations involved in the project of the canal around the falls of Niagara, those relating to military defences are first in a national point of view; scarcely less prominent, however, are those which relate to the amelioration of commercial relations between the highly-productive regions of the upper lakes and the Northeastern States.

Regarding it as a national military work, without adverting to the precise location of the canal, (which, by reference to the routes we have surveyed, would be matter for the locating engineer, as directed by the views of the National Government,) its advantages would be to give celerity to the movement of forces, munitions of war, shipping—in a word, the *materiel* of an army between the two lakes, Erie and Ontario; which, in case of war with Great Britain, would doubtless become the scene of active operations.

The efficiency imparted to military force, derived from the power of concentrating, is a principle in strategy too well understood to need illustration. In its application to our subject, we realize its value in a conspicuous manner.

It is almost certain that, in the event of hostilities between the United States and Great Britain, the naval warfare on the lakes would be extensively assisted, or, perhaps, entirely conducted, by vessels propelled by steam. In such case, their light draught of water would enable them to pass from one lake to the other with such dimensions of canal as have been projected.

This is a desideratum to which every mind must be sensible; it would impart mobility to our force, and enable us oftentimes to secure the fruits of a victory, or suddenly to repair the disasters of defeat.

By this facility, the invasion of our territory on either lake might be prevented, with all the concomitant, desolating effects of war. A thousand modifications of circumstances might be adduced, to show defeat and disaster to our arms as the result of the want of means of co-operation between our naval forces on the lakes; but I regard it as sufficient to lead the attention to this department of the subject, without occupying time with details which must be obvious to every intelligence.

Neither ought our Government to flatter itself that the British and Canadian Governments are insensible to the advantages to be derived, in such an event, from interior communication. The former has already constructed a steamboat canal, ostensibly for military purposes, from Montreal to Kingston; and one for commercial and military purposes, from lake Ontario to lake Erie.

The advantages to be derived to the British, in case of hostility, from these facilities, would be incalculable; and a commensurate caution is called for on our side, to counteract their tendency. Under the administration of the Duke of Wellington, a chain of communication by steamboat canals was opened from Montreal to Kingston, a distance of 246 miles. These consist of La Chine, Carrillon, Blondeau, and Grenville canals; but the project to which these are only accessory, is the Rideau canal, extending from Bytown to Kingston, 126 miles, which alone has cost the British Government the sum of six millions of dollars, and boasts of some

of the finest construction in the department of civil engineering existent in any country. Yet this is only a part of the project; and a line of military works is contemplated to secure it against aggression, and render it an efficient channel of communication in the event of war with the United States.

The works on the Rideau canal were constructed under the direction of Colonel By, of the royal engineers, assisted by officers of the same corps. It remains under surveillance of the engineer department, and officers of engineers are stationed at Bytown and Kingston, and intermediately, for that object. The military works at Quebec are proceeding to completion, at great expense; and the garrisons at various points of their frontier are by no means neglected. These facts are not irrelevant, as demonstrating that the British Government, although in time of profound peace, regard the military position of the colony with marked solicitude.

In sections of our country having no immediate relations with the Canadas, nor interest in the changes that are operating there, the generality of persons refer to the lessons of their boyhood as the sources of information, and they regard it as a bleak, sterile, unpopulated country, and a burden to the parental Government which sustains it. This, to a certain extent, was true but a few years ago: but the scene has changed materially, and a reference to statistic records will show that a very small portion of our own country can boast of a more rapid amelioration than has taken place in regard to the Canadian Provinces.

In 1834, by an official statement, it appears that the population of Upper Canada had doubled within eight years; that it is of a peculiarly valuable character; and that the development of agricultural and commercial resources has been commensurate.

A few facts will corroborate the truth of the remark. It is stated, upon good authority, that of late years the annual emigration to Canada from England, Ireland, and Scotland, amounts to from fifty to sixty thousand souls; and a cursory visit to that country will exhibit to us, most strikingly, the advantageous difference in character of that emigration and the one which is received in our Atlantic cities from the same source; and the cause is obvious. The industrious mechanic, the laborious pains-taking farmer, who, as the reward of their efforts, have enjoyed competency and comfort at home, when moved by the spirit of enterprise, do not wish to sever themselves entirely from those institutions under which they have derived those advantages; whilst the idle and improvident desire nothing so much as a change from a state of things under which they have suffered want and penury, and to which they, for the most part, unjustly attribute their ill fortune.

To this is to be added the great difficulty thrown in the way of the best class of emigration to this country by the British Government, with the facilities afforded to its establishment in the Provinces.

It became my duty, under instructions from those to whom I was referred by the department for my guidance during my operations of the last summer, to make myself, by personal observation, acquainted with the advance of improvement in this section of the continent.

Under these auspices, I was induced to diverge somewhat from the beaten track of visiters to the Canadas, and have verified, and can attest the truth of the foregoing observations; but their full illustration would be necessarily founded upon details in their relation incompatible with the

general nature of my report, but which, in their sum, have made a sensible and-well defined impression upon my mind.

As belonging immediately to my profession, however, I cannot help indulging in a comment upon some of the works of civil construction on the Rideau canal. At Bytown, Jones's falls, and Kingston mills, are certainly some of the finest specimens of hydraulic architecture on the continent of America. At Bytown are eight consecutive locks, seven of 10, and one of 11 feet lift, 133 feet long and 33 feet broad: these, as well as the locks at Kingston mills, are worthy of the highest admiration. But it is at Jones's falls that the most remarkable work is achieved. It consists of a dam 62 feet in height and 400 long, in solid masonry, and among the most perfect in existence; a waste wier cut through a solid rock, and a descent of 60 feet by three consecutive locks, and a fourth with an intermediate basin. The dimensions of the locks are as those above stated, with the extraordinary lift of 15 feet; yet, under the head of water consequent upon such a plan, there is scarcely the appearance of a leak, and the masonry is of the most finished and beautiful character.

I take this opportunity to express myself indebted to the frank and liberal politeness of the British officers generally, during my visit to the Canadas.

I have to thank Captain Bolton, of the royal engineers, not only for his elegant hospitality, but for the facilities he afforded me for observing many valuable modifications relating to my profession, and taking, in regard to the details of locks, &c., such memoranda and drawings as were suggested by many portions of this truly magnificent work of civil construction.

I have, perhaps, employed more emphasis than was necessary in regard to this subject; but I feel assured the work is scarcely known throughout the United States, otherwise than by name, even to professional engineers, and much less to the community generally; to whom, in reference to the subject in hand, I cannot but think it must prove interesting.

Resuming our discussion, let us now suppose a population of the kind to which I have referred, established, as it ultimately will be, in the extensive region comprised between the same parallels of latitude as Maine, New Hampshire, Massachusetts, and the southern boundary of New York, and lying between lake Superior on the west, and St. Lawrence river on the east, with lakes Huron, Erie, and Ontario on the south, possessing a climate attempered by the genial influence of surrounding inland seas; and we shall be made sensible, at once, of its imposing attitude, in every relation, to awaken a national solicitude.

But, limiting our view, it will be sufficient for our immediate object to concentrate our reflections upon the region in the neighborhood of the St. Lawrence, and the peninsula of Upper Canada, stretching itself far into the territory of the United States. It is this section, which will, in a few years, according to the present ratio, contend with any of our most flourishing States, both in population and resources, that we have just cause to regard with a jealous eye.

By the enterprise of the Canadians, a railroad is contemplated to connect lake Huron with lake Ontario. This project being carried into execution, (as it certainly will be,) it becomes the great portage between the upper lakes and lake Ontario, and will have an immediate influence in concentrating population, and developing the resources of this valuable territory.

When we contemplate the maps of this region, and notice the peninsula of Upper Canada jutting into our country, and reflect that, independently of its local advantages, with those of soil, climate, and population, it possesses a retired and guarded line of communication, issuing from the impregnable fortress of Quebec, in the hands of so great a military Power as Great Britain, we should not be insensible to such precautions as are calculated to increase the security of our frontier, whilst subserving in an eminent degree the cause of commerce, agriculture, and civil industry.

We are not so illusory as to interpose the Niagara canal as an *ægis* against the growing power to which we have alluded; but it should be regarded as one important measure, as concentrating population, by opening the facilities of collateral avenues, by rendering available the immense hydraulic advantages of which this point is susceptible, and by thus giving strength to this exposed frontier.

Were the National Government to purchase a site for armories, and establish foundries there, it would become the nucleus of a powerful manufacturing interest, and concentrate a population which, in time of war, would be ever ready to arm in defence of its threshold, and become the most efficient guaranty against aggression.

It must not be imagined that its contiguity to the frontier would render it unsafe for such object; for, supposing it to receive the attention from Government that it deserves, in a military aspect it may be regarded as one of the strongest defensible positions on our frontier.

On the west it is entirely inaccessible, by means of the rushing waters and precipitous banks of the Niagara river. To attack from the south, the enemy would be obliged to cross a considerable distance above the falls, and descend the river on the American side, through a densely settled section of country: his line of operations would therefore be attenuated, and eventually intercepted. On the east, in the supposition that the canal be constructed, its gorge would be unassailable by the interposition of a body of water of one hundred and ten feet wide, and ten deep, which would be rendered impassable by the resistance opposed, or at least produce a delay that would be incompatible with the nature of an enterprise requiring for success the greatest celerity.

The Lewiston ridge offers a barrier on the south side, which, with a little attention, might be rendered inaccessible. The Fort Niagara, within so short a distance of the only point where a landing could be effected on the Niagara river from the opposite shore, would be a sufficient preventive to an incursion from this quarter.

A landing for such object could only be effected by the want of precaution on our side, under cover of night, and by a small number. The enterprise would certainly be cut off by a detachment from the garrison, with which this position would stand in military relation, both offensive and defensive; aided, also, by armed parties of the inhabitants, inspired by patriotism, and rendered vigilant by a sense of insecurity from the proximity of the enemy.

In the execution of the project also to which I refer, this manufacturing district would become the terminus of avenues leading to every part of the State. Thus, an enemy of the force we refer to, once upon the high ground above the Lewiston ridge, and he would be assailed from every point with a promptitude that would render success to his enterprise, nay, an escape, impossible. With great deference, we advance the opinon that a

liberal policy would regard such a project as of the greatest national importance, as calculated to increase the strength of this at present assailable frontier, by augmenting its population and resources, and by providing it with arms and all the materials for defence.

The shield of national protection would be thus interposed, with a paternal care, to shelter the inhabitants of this section from the calamities incidental to their position in time of war.

But a more enlarged view may be taken in regard to the proposed project—a view in which I cannot but think the country at large, stimulated by a sense of national pride, must take a deep interest.

In the event of a war, it is apparent, from the increasing resources of Upper Canada, and the policy by which Great Britain appears to be actuated, that the most energetic efforts would be made upon the frontier; and it would be question of invasion from one side or the other, conducted upon an extensive scale. Should we not become the aggressors, it is almost obvious that the enemy would soon place himself in the attitude to become so.

A true policy, founded upon established principles, dictates that we should prepare for the contingency under any circumstances; but the more imperiously in the present instance, where the object may be effected with inconsiderable expenditure in ostensible military preparation, and without giving the slightest ground of complaint to a nation with whom we are at peace.

By the arts of peace, and for purposes of great commercial utility, we may prepare this section of the country to become, in case of emergency, a depot of inestimable value to the whole of our Northwestern frontier.

From this *point d'appui*, in the event of invasion from our side, troops and munitions of war could afford ready reinforcements to lines of operation, diverging, as they would do, from this point of contact of the hostile territories. Under the influence of its strength and its contiguous resources, the passage of the Niagara river could be commanded, both at the head and foot of navigation, below and above the falls.

In the circumstances under which Canada was placed last war, it was undoubtedly the plan to have cut off the enemy's line of operations on the St. Lawrence; as Canada would then have fallen into our hands for want of resources within herself.

But the face of things has changed in regard to that country, as already explained, and she would henceforward possess internal resources of no ordinary capacity. Moreover, to cut off the enemy's line of communication, which would be operated by the Rideau canal, and sustained by defensive works, would require a more extended line of operations on our part, greatly calculated to weaken our position in that quarter.

We should, therefore, be obliged to turn our attention to the invasion of Upper Canada; and, with this object in view, such a point as the one to which we refer would become a principle of energy. It would give consistency to our project of campaign, by reducing our lines of operation to their minimum; inspire confidence in the militia, by the idea of the proximity of a place of support; and enable us to improve good fortune, or recover from the effects of bad; in a word, it would enable us not only to achieve victories, but render them valuable in their results.

With such resources at hand, we should be enabled to effect that greatest of desiderata, to carry the war into the enemy's country; whilst our

own soil and firesides upon this frontier should be guarantied from the horrors of invasion.

In contemplating a state of things such as this hypothesis is founded upon, I do not think my views can be deemed visionary, however tranquil may appear the horizon in this quarter at the present moment. Indeed, all history teems with the assurance that war is a state of things inseparable from the nature of man, springing from causes so light in their incipiency as to baffle the speculations or the predictions of the most profound political wisdom in assigning results to the diplomatic intercourse of nations.

But, waiving the idea of collision with the Canadas, it may be shown that the site referred to possesses many peculiar advantages as a manufacturing depot, to suit the most general emergencies; and the existing posture of affairs with a powerful maritime nation may possibly give some weight to the propositions I am about to advance.

The stupendous peculiarity of its hydraulic advantages needs no comment. I will not attempt to demonstrate what may be regarded as a proverb: it is unquestionable that a greater water power, and that too in its application to practical purposes, can there be commanded than at any other point on the surface of the globe.

It is the advantages of its local position, in conjunction with its other attributes, that I shall endeavor to illustrate. For, let us suppose a hostile fleet blockading our Eastern and Southern coast, and the communication on the seaboard entirely cut off between them—a case which obviously might occur—and then turn our reflections to the unprotected state of our Gulf coast, its present destitution of the materials necessary to its defence, and the aid it would always require in the exigency of war from the Northern States; and the policy, even necessity, of its possessing some great military depot in a secure and sheltered situation, becomes impressively obvious.

The district of which it is a portion stands in bold relief, by reference both to its central position and the properties required.

If the attention be turned towards the map of the United States, with this object in view, the mind will be struck with its peculiar advantages.

The Hudson and Erie canal passes its threshold; New York is, therefore, at hand. The Susquehanna, with its outstretched arms, approaches it nearly; Philadelphia and Baltimore, the Delaware and Chesapeake, are, therefore, its neighbors. The St. Lawrence, and the avenues to lake Champlain, and thence the branches of canal through the Eastern States, form a continuous navigation. The vast empire of water of the great lakes is spread before it; but, above all, in the sense we at present regard it, New Orleans and our Southern coast, through the great valley of the Mississippi and the canals either projected or already executed, stand in a relation to it that we think should render it a locality of peculiar national interest, and highly entitled to a portion of that public expenditure which belongs to a general system of precautionary and defensive measures.

By means of the Niagara ship canal, the Oswego ship canal, projected, and those above referred to, a secure, capacious, and expeditious medium of transit, by steam navigation, is opened between the chief cities of our Eastern coast, and the vast unprotected territory of our Southern maritime frontier.

We will now advert to the commercial advantages to be diffused by the project, so far as they are of a nature, by their generality, to call for the

aid of the National Government. We regard as paramount the connexion of the lakes Superior, Michigan, Huron, and Erie, with the lake Ontario, which, by their extent and depth, may be severally regarded as inland seas, and which belong not to any particular State, so far as they are within our boundary, but to the entire jurisdiction of the United States; the rendering maritime several thousand miles of lake coast, by opening to it the only obstruction to direct commerce with the Atlantic, through the channel of the St. Lawrence, secured in equal participation by treaty to the United States. To render the coast of the United States, upon our upper lakes, in immediate commercial relation with a foreign nation bordering the lower lake and the St. Lawrence, and with our own coast on the lower lake; placing in immediate commercial relation the United States coast of the upper lakes with the great commercial depot of New York, through the medium of the Oswego and Hudson ship canal, to be executed by the State of New York, with the extraordinary dimensions given to the St. Lawrence canal, now executing, in conjunction with the projected Niagara canal, ships of three hundred tons might navigate from the Atlantic ocean to the ports on our upper lakes.

We may assume, even, that a large class of merchant ships, by a construction modified as in some mercantile nations of Europe, might be adapted to this trade.

In discussing the subject of draught in vessels, when we regard the elements which enter in assigning the burden to any particular draught, we are not struck with any difficulty in the question theoretically, inasmuch as it is determined generally by the length multiplied into the breadth into the depth, either of which factors may be changed at will; and we may, therefore, build a very flat vessel to carry a very large cargo, by increasing two of the elements, length and breadth, and yet diminishing the third. As our plan of canal, and length of locks, admit of considerable latitude in regard to the two former dimensions, no obstacle may be supposed to the adoption of a construction of vessels that shall be calculated to carry a cargo of a magnitude within any desirable limit.

But I felt desirous of knowing whether the ordinary relative draught was not prescribed by the consideration of practical benefits, and whether circumstances of sailing or general manageableness did not, in some measure, militate against a change of model; and I therefore requested information through the medium of a gentleman whose official character gave him an opportunity of procuring the data required. The following letter addressed to the Hon. J. Turrill, from a source of undoubted respectability, establishes the proposition I have advanced :

New York, *March* 10, 1836.

My Dear Sir: On conferring with those who are eminently skilful in the scientific, as well as those who confessedly are in the practical branches of ship-building, I have gathered the following particulars, in reply to the queries of our mutual friend, McWhorter, addressed to me on the subject, with reference to the projected ship canal.

It is not necessary, in order to ensure great sailing, to give a ship a great deal of dead rise, but the contrary; as may be exemplified in simultaneously launching two ships of equal dimensions, say same length, width, and depth; one with twenty-eight inches dead rise and short floor, and the other with fourteen inches with a long floor. The sharp ship will

draw about three feet more than the flat one, and will require considerably more ballast; so that when all their armament, stores, water, &c. are on board, you will perceive that the sharp vessel is drawing about four feet more water than the flat one: hence it is reasonable to infer that the ship with the least dead rise will displace less water than the other. Mr. Webb (the associate of the late Mr. Eckford) assures me that a frigate of the largest class can be so constructed as to have all the qualities that can well be united in one ship, and be put in a condition for transporting, &c., and not to exceed a draught of twelve feet. Flat and sharp vessels may, in fact, be thus contrasted: what the one may gain by being sharp, the other acquires by extra buoyancy, losing nothing in going to windward by the *peculiar* turn in the bilge. The word *peculiar* I may explain by saying that great sailing may be attained by giving half an inch dead rise to every foot in width; but ships built upon this mode must have the middle futtocks crooked with an abrupt turn in the bilge, straight sides; and the thinner the ends in proportion to the draught of water, the greater the speed; and they are sure, from the abrupt turn in the bilge, to go to windward well, and also to steer well.

Pray inform me if the foregoing particulars are sufficiently to the point to meet the object of your inquiries, or what other or further illustrations you require; and I will, as far as my time and my means of obtaining them admit, most cheerfully respond therto.

Remaining, dear sir, yours, faithfully,

JOSEPH FOWLER.

The innovation to which our supposition refers need not excite surprise, when we reflect that it would accomplish the object of accommodating a development of coast such as we have stated, and possessing a back country as rich in resources as any on the face of the globe. The advantages of direct communication appear more striking when we reflect upon the great increase of expense in transportation, arising from the necessity of transhipment of the objects of trade at various points of the route.

It is stated in a report of the board of directors of the Welland canal, 1835, that "merchandise from London would be conveyed to Cleaveland for £2 10*s*. per ton, which now costs from £3 to £4 from Montreal to Prescott, a distance of 130 miles only." This, when the St. Lawrence shall be rendered navigable by the work now constructing.

Other statements are before me, entering greatly into detail, and exhibiting still more strikingly the advantages of preserving the bulk of merchandise unbroken, from the time of its shipment until its arrival at its ultimate destination.

These are considerations involving an amelioration to commerce, by its extent and utility, worthy the patronage of a paternal Government. The Niagara ship canal is a work that in its consummation would awaken into life a thousand springs of latent resources, by the facilities it would give to the transportation of objects of agricultural and manufacturing industry; and referring to the broad principle of analogy for our support, we infer that a country, such as that which borders our upper lakes, teeming with undeveloped agricultural and mineral treasure, when brought by the facilities of steam navigation within a greatly diminished distance, by reference to time, of the emporium of New York, and other of our great mer-

cantile cities, will receive an increment to its population, and develop its resources in a degree commensurate with the great avenues of commerce to which we refer, and surpassing all former experience.

We have practical demonstration of the increase of population, and the consequent development of resources, in the region of the upper lakes, owing to the facilities afforded by the Erie canal, that through the State of Pennsylvania, the Mississippi river, and the various other collateral branches.

But it should be remembered that this tide of emigration is yet incipient; it has scarcely received its impulse ; whilst the avenues that encouraged the emigrant by their facilities, are arriving at their maximum of utility, in consequence of the increase of commerce upon them.

It is true that a new channel is opening to these fertile regions—the outlet of the St. Lawrence. The improvements to which I have already referred in my report, namely, the Welland and St. Lawrence canals, will offer a ready means of bringing their products to a market ; but the emporium they will reach will be that of a foreign nation. Montreal will enter into competition with our own markets.

It is no longer question of preventing the descent of produce from the upper lakes to lake Ontario. The Welland canal, executed by the Canadians, has already achieved that object, and it has proven the fallacy of the reasoning that "produce, once afloat on lake Ontario, will find its way to Montreal."

It is only when the increasing amount of trade shall become more than commensurate with the facilities afforded to deliver it at the emporium of New York or other of our Eastern cities, that rivalry is to be apprehended. This has been abundantly demonstrated ; for, although an entire navigation exists from lake Ontario, by means of the Rideau, Grenville, and La Chine canals, yet does by far the greater portion of the produce of the upper lakes and shores of lake Ontario find its way through the Oswego and Erie canals to New York.

The Oswego and Erie canals, in their present state, contend successfully against the competition of the St. Lawrence. But new facilities are preparing by Canadian enterprise, and the St. Lawrence canal will bring the market of Montreal nearer to the source of produce by several days, without the necessity of intermediate transhipment ; thereby effecting a considerable diminution of the cost of transportation. How far this circumstance will deteriorate the value of our own channels of commerce, is worthy of deep consideration.

For the sources of produce, it is of course desirable to possess many outlets. But it seems clear that the policy of the State of New York would find it expedient to anticipate the demand for market-way ; for when its necessity shall have taught the inhabitants on the borders of the upper lakes the facilities of the St. Lawrence canal, it would be difficult, if its advantages are such as are in anticipation ascribed to it, to divert the tendency of produce from Montreal.

The Hudson and Oswego ship canal is a work particularly interesting to the city and State of New York, and the State will eventually, or perhaps immediately, recognise it as the true line of communication, in conjunction with the projected Niagara canal, between New York and the Northwestern States.

The simple fact that it saves a distance of artificial navigation of 120

miles, and only increases the absolute distance by 15 miles, and a few feet of lockage, is a sufficient element to establish its great relative economy; and this hypothesis is sustained by experience: for it appears by official returns, that there is a saving of expense on the amount of goods transported between New York and Cleaveland, of upwards of 30 per cent. by this route over that by Buffalo, even under the present inauspicious circumstance of a defective channel of communication around the falls of Niagara, through the Welland canal.

It should be remarked that this work is defective, both in its location and construction; not arising, I infer, from want of judgment in the engineers, but from the desire to complete a great project with inadequate means. In its present situation, constant delays are to be apprehended in the passage of vessels; and to render it an efficient thoroughfare, would involve a very serious expenditure of money—an expense that would continually recur, unless the whole plan of the work should be remodelled.

In its present state, if the Niagara canal on our side should merely be determined on, the great efforts now making by the Canadians to give to the Welland canal a greater degree of efficiency would probably be rendered unavailing, and it would eventually sink into disuse.

This effect obviously resolves itself into a consideration of great importance, and suggests the expediency of an immediate action in regard to the measures herein recommended.

The next commercial benefit to be derived from the Niagara canal is that which relates to the Northeastern portion of our country, by the Ogdensburg canal, and by the St. Lawrence and Plattsburg canal, which have been already projected, and which would doubtlessly be executed in the event to which we refer; the produce of our far West would be conducted to the waters of lake Champlain, and thence by the projected La Morelle canal, Montpelier canal, Passumpsic canal, &c., to every section of New England; and, in return, a most economical outlet would be presented for the active manufacturing and productive industry of that enterprising portion of our country.

It would be impossible, without rendering our report too voluminous, to enter into detail in regard to the various ramifications of commercial enterprise that would, in all probability, receive an impulse, should it become an object of national interest to remove the barrier in an efficient manner between lakes Erie and Ontario, improve the harbors upon their extensive coasts, effect the communication between lake Michigan and the Illinois river—in a word, by its paternal influence, constitute the national waters of our Northern lakes a common market-way to the various States bordering upon them, or enjoying their influence in a less immediate degree.

In order to avoid enumeration of details, I have appended to the accompanying map of the survey a general map of the States to which my report has reference, showing the various canals projected or executed. It will exhibit at a glance the relative dependence of many of them for increased success upon the removal of the obstruction to navigation between the two lakes, Erie and Ontario; it will likewise illustrate certain passages of my report referring to the Provinces of Upper and Lower Canada.

The various topographical data in regard to the lakes are marked upon the map. A comparative estimate is also noted of the development of coast bordering these inland seas, and that of our Atlantic and Southern

coast. By this it appears that the length of the lake coast exceeds the whole extent of that of the Atlantic, from Passamaquoddy bay to Sabine river, by two thousand miles.

Of this development of lake coast, the portion on lake Ontario will be united to the ocean by a ship canal on the St. Lawrence, to which I have already referred.

The remaining portion is separated, in regard to steamboats and ships of moderate burden, by the obstruction on the Niagara river, to which my report refers.

The territory that would be sensibly benefited, under the hypothesis of this removal by the plan proposed, would be principally New York, Ohio, Michigan, a portion of Pennsylvania, Virginia, Indiana, Illinois, Kentucky, Missouri, and even remotely the Northwestern Territory. Moreover, the sphere of commercial transit upon the great channel of the Mississippi will, by the facilities of this project, be greatly enlarged. A steamboat navigation from New York to New Orleans would open a new era in the destinies of the Southwestern States of our confederacy. We cannot, I think, refer with too much emphasis to the projected ship canal between lake Michigan and the Mississippi, by the Des Plaines and the Illinois rivers.

The project is ably treated in a letter from the United States Chief Engineer, in answer to a call for information from a member of the United States Legislature upon that subject. The distance between New York and New Orleans by this route, and that by sea, around Cape Florida, as deduced from Tanner's map of the United States, is nearly the same; but when we reflect upon the dangerous navigation, and the increased distance by the divergency of the ship from her proper course, arising from adverse winds, which, by reference to the going and return voyage, must be estimated at one-fourth, we must be forcibly struck with the advantages that the combined project would afford to the commercial intercourse between New York and the great emporium of the South, and the idea it suggests of healthful action to the commercial and agricultural relations of the intermediate points.

The distance we have carefully measured, on the map, between New York and New Orleans, by way of Oswego, Niagara, Maumee, and Wabash canal, and it amounts to two thousand and eighty-five; whilst the distance around the Florida coast is two thousand two hundred and fifty; leaving a balance in favor of the lake route of one hundred and sixty-five miles.

Another branch of my report relates to the advantages to be derived to the General Government by the facilities given to emigration, and bringing, in respect to time, a remote and unpeopled frontier in closer contiguity with more densely inhabited and civilized regions; thereby enhancing the value of the public domains, and procuring for them a more ready and advantageous sale.

This consideration is of more importance than might appear from first glance. When we reflect that the economy of a journey depends, in so great a degree, upon its continuity and despatch, delays at points of a route where conveyances are changed, obliging the emigrant to incur the expensive charges of cities or towns, are a barrier to emigration; because the expenses of the whole route cannot be calculated previously to departure, and a consequent apprehension is inspired to many of the poorer

classes, who eventually exhaust their resources in the cities where they debark, and, by compulsion of poverty, remain there; thus, instead of becoming a valuable accession, by their labors, to the thinly-populated territory of the West, they oftentimes become a burden and expense to the community which has the misfortune to receive them. The project in question, with the Oswego and Hudson canals, would afford a cheap, continuous, and rapid mode of transportation, by steam, from New York to the remote public domains of our upper lakes.

In conjunction with the St. Lawrence canal, Montreal and Quebec would stand in a similar relation; and those great recipients of European emigration would send forth, with renewed impulse, their thousands, to render many a tract of wilderness the abodes of industry, social happiness, and refinement.

A consideration of very great importance, and of a character calling for an amelioration, is that which relates to the shipping interests of the lakes, under existing circumstances. The vessels navigating the lakes are, during the rigors of winter, blocked in their harbors by the ice; by this means, a large amount of capital, invested in shipping employed on the lakes, is neutralized for several months of the year. A deterioration of property, proportionate thereto, ensues; and the deprivation of employment of a valuable class of citizens, in the seamen by whom they are navigated. This would be remedied by the proposed project, in conjunction with the Oswego and Hudson canals, or even independently of the latter, by the project of a steamboat canal, now executing on the St. Lawrence river, under the auspices of the Canadian Government. Should the Niagara ship canal be constructed, the shipping interest of the upper lakes would participate in this advantage.

This remark applies with equal propriety to Government vessels that in any contingency may be built and employed upon the lakes, when the service upon which they might have been required there shall cease.

They could, by the means we suggest, be lightened of their armament, and brought down to our Eastern seaboard for other employment. The full force of this suggestion would have been felt at the expiration of the last war with Great Britain, when our naval preparations upon the lakes became entirely useless, and a dead loss to the nation.

I have now completed a cursory review of such general considerations as have appeared to merit, in my estimation, the notice of Government. In this, I have endeavored to avoid minutiæ, foreseeing that they would render my report both fatiguing and voluminous. My desire has been rather to call attention to the various points upon which an argument might be based, than to take upon myself the task of development.

I have also felt, in the course of my remarks, that too much detail would but embarrass the natural course of thought; and that the subject itself, if brought to the reflection, would carry conviction in its train. If I have shown more interest in the question than is usually looked for at the hands of the engineer, it is that I have felt the strongest conviction of the grandeur, even sublimity, of the enterprise, combined with its general usefulness to the country, and the facility of its execution.

I have now the honor to submit the present memoir, with the various plans, maps, profiles, and other illustrations, connected with the survey.

I am, sir, most respectfully, your obedient servant,

W. G. WILLIAMS,
Captain U. S. Top. Engineers.

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